Assignment 14.2 Questions 7, 13, 15, 17, 38, 40, 44, 52, 65-69 odd

7) All water solutions have both H+ and OH- ions. Bases, like NaOH, just have a lot more OH- than H+.

13) pH is the (negative) power of 10 of the concentrations of hydronium.

False, concentrated weak acids can have a lower pH than a dilute strong acid.

15) pH can be negative if you have a strong acid w/ a concentration above 1M

ex: 10M HCl has a pH of -1.

17) Normally those numbers have 4, 3, and 2 sig figs respectively. As a pH, they all have 2 sig figs. The numbers before the decimal point are powers of 10.

38) a. $[H^+]\,[1.5] = 10^{-14}$

$[H^+] = 6.7 \times 10^{-15}$ M (basic)

b. $[H^+]\,[3.6 \times 10^{-15}] = 10^{-14}$

$[H^+] = 2.8$ M (acidic)

c. $[H^+]\,[1 \times 10\text{-}7] = 10^{-14}$

$[H^+] = 1 \times 10^{-7}$M (neutral)

d. $[H^+]\,[7.3 \times 10^{-4}] = 10^{-14}$

$[H^+] = 1.4 \times 10^{-11}$M (basic)

40) a. $K_w = [H^+]\,[OH^-] = 2.92 \times 10^{-14}$

$x = \sqrt{2.92 \times 10^{-14}}$

$x = 1.71 \times 10^{-7}$M

c. $K_w = [H^+]\,[0.10] = 2.92 \times 10^{-14}$

$[H^+] = 2.92 \times 10^{-13}$ M

44)

pH	pOH	$[H^+]$ (M)	$[OH^-]$ (M)	
9.63	4.37	2.3×10^{-10}	4.3×10^{-5}	basic
8.59	5.41	2.6×10^{-9}	3.9×10^{-6}	basic
1.57	12.43	0.027	3.7×10^{-13}	acidic
1.8	12.2	$2. \times 10^{-2}$	6×10^{-13}	acidic

52) a. $[H^+] = 10\text{-}5.10 = 7.94 \times 10^{-6}$ M

$$\frac{0.250\ \text{L} \mid 7.94 \times 10^{-6}\ \text{mol} \mid 63.018\ \text{g}}{\qquad\quad \mid\ 1\ \text{L} \mid\ 1\ \text{mol}} = 1.3 \times 10^{-4}\ \text{g}\ HNO^3$$

65) $$[H^+] = \frac{0.15\ \text{mol} \mid 3.0\ \text{mol}}{\text{L} \mid\ 100\ \text{mol}} = 4.5 \times 10^{-3}\ \text{M}$$

$$K_a = \frac{[H^+]\,[X^-]}{[HX]} = \frac{(4.5 \times 10^{-3})^2}{0.15 - 4.5 \times 10^{-3}} = \frac{2.025 \times 10^{-5}}{0.1455} = 1.4 \times 10^{-4}$$

67) $[H^+] = 10^{-2.77} = 0.0017$M

$$Ka = \frac{[H^+]\,[OCN^-]}{[HOCN]} = \frac{(0.0017)^2}{0.0100 - 0.0017} = \frac{2.89 \times 10^{-6}}{0.0083} = 3.5 \times 10^{-4}$$

69) $[H^+] = 10^{-2.70} = 0.0020$M

$$1.8 \times 10^{-4} = \frac{[H^+]\,[COOH^-]}{[HCOOH]} = \frac{(0.0020)^2}{x - 0.0020}$$

$1.8 \times 10^{-4}\,(x - 0.0020) = 4.0 \times 10^{-6}$

$1.8 \times 10^{-4}\,x - 3.6 \times 10^{-7} = 4.0 \times 10^{-6}$

$1.8 \times 10^{-4}\,x = 4.36 \times 10^{-6}$ **x = 0.024 M**